Report to the Energy Efficiency Utility Contract Administrator

Verification for Efficiency Vermont Year 2000 Savings and Total Resource Benefit (TRB) Claim

Department of Public Service

May 2, 2001

Summary

On March 1, 2001, Efficiency Vermont (EVT) filed its Year 2000 Report on its first year activities and result operating as the Statewide Energy Efficiency Utility. As provided for in the contract between Efficiency Vermont and the Vermont Public Service Board, the Department undertook a review of EVT's 2000 activities with the goal of "verifying" the annualized MWh savings and Total Resource Benefit amount claimed by EVT. This report to Mike Wickenden, Contract Administrator for the PSB, summarizes the results of that review.

The DPS recommends that EVT's annualized MWh savings be reduced from the claimed **23,335** MWh's to **22, 831** MWh's. This is a reduction of 504 MWh or about 2.2% lower than the savings claimed in EVT's March 1 report. The Total Resource Benefit (TRB) should be lowered by $ 2,749,726 or 13.8% . This changes EVT's claimed TRB for the year 2000 from **$19,931,041** to **$ 17,181,315**.

The DPS and EVT have reached agreement on all but one issue raised in this review. The subject in dispute is the methodology and assumptions used to estimate savings for a particular technology known as variable speed drives (VSD's). This report contains a fairly detailed discussion of the DPS findings and reasoning related to its proposed adjustment to the savings EVT claims for these projects.

The balance of the subjects raised, and their proposed resolution, are briefly described. The report also includes a description of the DPS review process and a discussion of an agreement reached on the review of EVT's Technical Reference Manual.

The DPS would like to commend all EVT staff involved in this process. Their professionalism in sharing their time and knowledge has made this process one that has strengthened both parties understanding of the issues confronting Efficiency Vermont and the DPS as we move forward with the statewide energy efficiency utility.

DPS Review Process

Over a two month period covering March and April, 2001, DPS staff members Randall Lloyd and Carole Welch worked with DPS contractors West Hill Energy and Computing to plan and implement the review, and develop the conclusions and recommendations contained in this report.

Using EVT's database, West Hill constructed a list of the 100 largest projects from the EVT database, and used this list to identify projects for review. Multiple site visits to EVT offices were made during March and early April to review project files and discuss projects with EVT staff. West Hill used EVT's database to check savings assumptions for prescriptive measures against the reference manual and to verify prescriptive savings for the residential programs. Electronic files from selected projects used by EVT to calculate savings and screen measures were reviewed.

The DPS provided EVT with a draft list of issues on Monday, April 9. On April 12, a meeting was held between EVT, the Contract Administrator, and the DPS to present the DPS preliminary issues and discuss EVT's preliminary response. Additional investigation, analysis, and discussion was undertaken by both the DPS and EVT. On April 17, EVT provided its written response to the DPS' preliminary issues. A second meeting between EVT and the DPS was held on April 19. At that meeting, mutually agreed upon resolutions were reached on all but one issue.

Findings

The results of the DPS review are presented in this report under one of four categories, as follows:

Category 1: Unresolved Issue with Adjustments
Category 2: Resolved Issues with Adjustments
Category 3: Issues Without Adjustments, Requiring Future Attention
Category 4: Process and Other Issues

In general, items in all categories will require further action. Most, if not all, of the issues identified and discussed under categories 1, 2, & 3 will be referred to the Technical Advisory Group (TAG). The report also includes a number of process issues and concerns that were identified during the review process. These will require EVT attention and perhaps further discussion/negotiation. Finally, this report contains a discussion and agreement on the DPS review of EVT's Technical Reference Manual (TRM).

Category 1: Unresolved Issue

The DPS and EVT have not reached agreement on the appropriate savings to claim for two large variable speed drive (VSD) projects in the Commercial Energy Opportunities Program. The issue is discussed below.

CEO Program: Variable Speed Drives (VSD's)

Cabot Cheese Project

The Cabot Cheese project includes the installation of 3 VSD's on 20 hp vacuum pumps. Savings were claimed based on the post-installation operating frequency of the drives at the time of a site visit. The DPS understands no pre-installation measurements were made. Both annual kWh and KW savings were calculated to be 75% of the estimated original usage of the pumps using the following assumptions:

1) The motor is loaded at 80% before and after installation.
2) The VSD itself is 100% efficient.
3) Cabot Cheese's processes will remain constant for the estimated 20 years of the measure life.

There are a number of concerns about this analysis that are listed below.

A. A literature review, including material provided by EVT, indicates that process flow measurements down stream from any controlling devices need to be made, and a usage profile developed, to calculate reasonably accurate savings estimates. In fact, VSD savings generally relate to changes in the system rather than reductions in the motor use. EVT states the savings estimated are based solely on post-installation measurements.

B. Technical literature suggests that savings for VSD's are generally 35% to 50% of original use, and case studies available to the DPS do not show savings above these levels. EVT states that their savings estimate is correct, even conservative, since they are using the square of the motor loading rather than the cube as the affinity law would indicate. However, it is not clear this application of the affinity law is correct in this situation.

C. The users' guide to EPRI's ASD Master software (for calculating VSD savings) recommends two steps common to all VSD applications: 1) determine how shaft speed will vary over time and 2) determine how power relates to speed. In EVT's analysis, the first step was completed but the second one was omitted.

D. VSD's are generally 92% to 96% efficient. EVT did not adjust savings to account for the efficiency rating of the VSD's.

E. It seems likely that Cabot Cheese will make some adjustments to its processes over the course of twenty years. It seems reasonable to make some adjustment to savings to account for potential changes in the process over time, possibly by applying a persistence factor.

DPS Recommendation: The energy savings should be reduced from 75% to 45% of the original pump usage. It is not possible to make a better estimate of savings without the pre- and post-installation measurements.

Essex Community Center Project

The Essex Community Center is a library addition to the Essex High School. Savings are claimed for the installation of two VSD's in the HVAC system on the constant flow air handler. The savings are based on the amount of time the air handler provides air conditioning or heating at design load. Optimal Energy has developed generic savings profiles for VSD's installed for various applications and in various building types. These profiles were used to calculate the savings for this project. The application of the savings profile resulting in savings of 71.5% in the winter to 86% during the summer peak from the baseline energy consumption. It was not possible to review all the assumptions used to develop this savings profile within the time constraints of this verification process. The profiles were developed using the affinity law, although Optimal Energy adjusted the cube exponent to 2.5 to address the overstatement of savings from using this methodology.

Demand Savings

EVT has informed the DPS that an error was made in calculating the demand savings. They have corrected the savings from 24.0 to 2.1 KW for the two fans. This correction is reflected in the attached chart.

Energy Savings

EVT states the savings estimates are conservative because the profiles were developed for southern New York where there is a higher air conditioning load. Also, HVAC equipment is generally oversized. EVT provided an EPRI article which indicates that up to 80% savings may be achieved when comparing VSD's to outlet dampers for controlling air flow. However, this article clearly states that site specific analysis is required to calculate savings.

The DPS is not willing to support energy savings at this level without a site-specific analysis and EVT has not demonstrated that such an analysis was conducted. Factors such as the amount of air flow needed for ASHRAE 62 occupant air requirements, building occupancy, waste heat cooling load, electrical losses within the VSD, the fan curve and frictional losses within the HVAC system should be considered in this analysis.

DPS recommendation: The savings should be reduced to 45% of the baseline fan energy usage. It is not possible to make a better estimate of savings without site specific measurements.

Category 2: Resolved Issues with Adjustments

EVT and the DPS have reached agreements on specific adjustments for the following measures. These adjustments are reflected in the attached chart.

1. CEO Program: Fuel Switching

In the CEO program, EVT claimed full savings for four fuel switches. The DPS reviewed the largest project, the Brandon waste water treatment plant, and learned that the Brandon project manager had come to EVT with the fuel switch already planned and bid. EVT offered an incentive for improving the efficiency of the fossil fuel equipment. Brandon received a $1,000 incentive to install an 84% rather than an 80% efficient boiler. EVT claimed electrical savings equal to the total savings from the fuel switch.

The DPS and EVT have agreed that the free rider rate should be increased from 5% to 50% for fuel switching projects which are largely planned prior to contact with EVT. The reductions in claimed savings and TRB as a result of changing the free-rider rate for the four CEO fuel switching projects are listed on the attached chart.

2. CEO Program: Interruptible loads

Three CEO Program participants with interruptible contracts (Stratton, Bromley and Killington ski areas) installed measures during 2000. These measures were screened with the total KW demand reduction, although the load is likely interrupted at the time of the coincident peak(s).

The DPS and EVT have agreed that the peak KW savings and corresponding TRB should be reduced by 50% as a reasonable adjustment given the current ISO peak methodology. This reduction affects claimed savings for the snow making projects at Stratton and Bromley, and the water pumping project at Killington.

3. CEO Program: Grafton Cheese refrigerated warehouse

Three refrigeration measures (economizer, scroll compressor, and controls) with a high degree of interaction and very large savings, in excess of 40 MWh's each, were installed. The EVT savings claim did not reflect adjustments to account for the interactive effects.

The DPS and EVT agree that interactive effects should be incorporated into the analysis. EVT revised the savings accordingly and provided the results to the DPS. The change is included in the attached chart.

4. Efficient Products Program: Clothes Washers

The energy savings associated with the horizontal axis washing machines were overstated for two reasons: first, water pump savings of 20 kWh were added to each installation, and second, the assumed mix of water heating and dryer fuel types used to calculate savings did not match the actual data provided by the program subcontractor. Also, in calculating the TRB, EVT assumed that participants had access only to propane, i.e., no participants had natural gas.

The DPS and EVT agreed to revise the kWh savings to apply the water pump savings to a portion of the participants who are assumed to use water pumps and to correct the mix of water heating and dryer fuel types to be consistent with the year 2000 data. The TRB was also adjusted to remove a portion of the kWh related to the water pumps and to correct the fuel mix for consistency with year 2000 data and for the incidence of natural gas.

5. EPP: Torchieres

EVT used savings estimates for torchieres that are higher than the estimates in the July, 2000 version of the reference manual and higher than the estimates used in the October TRB calculation. EVT and the DPS have agreed to reduce the energy savings for the torchieres to 262 kWh per year, consistent with the October TRB calculations and the February, 2001 technical reference manual.

6. RNC Program: Energy Rating Savings

In the RNC program, EVT claimed savings for improvements made beyond what is required to meet the RBES code. The DPS reviewed the methodology and is generally in agreement. However, there were two errors in the TRB savings for these measures: 1) EVT did not take into account the higher RBES code for multifamily buildings, and 2) five single family homes were included in the savings although these homes did not meet the RBES standard.

The DPS and EVT have agreed to correct the TRB savings for these two errors, as shown in the attached chart.

Category 3: Savings Issues Without Adjustments, Requiring Future Attention

The issues listed under this category were identified during the verification process, but did not rise to the level of requiring adjustments to the year 2000 savings and TRB claim. In general, these issues will be addressed through the process for reviewing the technical reference manual and will be referred to the Technical Advisory Group for consideration. The exception is the Ben & Jerry's project, which requires future DPS action.

1. CEO Program: Ben & Jerry's

Green Mountain Power (GMP) had been working with Ben and Jerry's prior to Efficiency Vermont's start-up. This project was passed on to EVT as part of the transition. GMP and Hydro Quebec conducted an engineering analysis and recommended numerous measures. A VSD was installed on a compressor during 2000 and the associated savings mistakenly claimed in 2000 even though the incentive payment was not made until early 2001.[1] A number of other measures are pending, and there may be interactive effects between the VSD and the other measures. The DPS has agreed to the savings claim for the year 2000 with the understanding that the DPS will review the project in its entirety after it is completed.

2. CEO Program: Act 250 Projects

The Stratton Mountain Long Trail House project highlighted a degree of confusion and some misunderstandings between the DPS and EVT regarding the agreement and process for claiming savings for ACT 250 projects. Items that need discussion include the application of the adjustment/impact factor and the agreement on appropriate savings assumptions, such as operating hours. Other issues to address include the proper documentation of internal procedures to verify project size (sq. ft.), operating hours and Adjustment/Impact Factors for Act 250 prescriptive Lighting Power Allowances.

3. EPP Program: Lighting and Clothes Washers

EVT is using generic savings estimates for lighting measures and clothes washers in this program, although its subcontractor provides detailed, customer-specific information on most installations. The DPS would like to discuss the potential for calculating customer-specific

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[1] It is EVT's policy to wait to claim savings until an entire project has been completed and the incentives have been paid.

savings based on the data currently being collected. Also, the DPS would like to review the basis for adjustments to savings claimed for torchieres.

4. RNC Program: Energy Rating Savings Above Code

Just as with the EPP program, the DPS would like to discuss the potential for using customer-specific data already being collected for the purpose of calculating savings more accurately.

5. Interactive effects

Interactive effects may include such factors as waste heat and air conditioning load in commercial lighting projects, complementary refrigeration measures, and lighting controls and efficient lighting products. While EVT states it calculates lighting controls savings assuming efficient lamps have been installed, there is no clear methodology for addressing interactive effects for other measures. For example, two of the installations made during 2000 were for efficient cooler lighting in a supermarket. It appears the lighting was installed inside the coolers, which would result in savings in refrigeration as well as lighting load. EVT did not claim the additional interactive savings for this project, although it would have been reasonable to do so. Consideration of interactive issues should be incorporated into measure savings analysis and program delivery, and the methodology described in the technical reference manual.

6. CEO Program: VSD's

Both EVT and the DPS expect the use of this technology as an effective efficiency measure will increase as EVT's programs progress. The issues identified for specific year 2000 installations are described under Category 1 of this document, but other issues must be identified and addressed.[2] The savings calculation methodology and assumptions for this technology should be addressed by the Commercial TAG so that agreement between EVT and the DPS is reached and a recommendation made that will be documented in the TRM, incorporated into EVT's analysis procedures, and otherwise appropriately considered in program implementation.

7. CEO Program: O&M Savings

Another item needing attention is consideration of a mechanism to adjust estimated savings for O&M intensive measures, and possibly apply persistence factors for prescriptive measures and custom measures not incorporating O&M follow up.

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[2] For example, EVT uses a 20 year measure life assumption for VSD's while the DPS believes a 15 year life may be more appropriate.

8. CEO Program: Productivity Issues

It would be useful for EVT to provide input to the DPS to characterize productivity changes made in conjunction with industrial and large commercial efficiency projects. This might involve documenting additional tangible benefits that are not currently addressed or quantified in the TRB calculation methodology such as improved power factor, reduced customer bills due to ratchet clauses, reduced on-site emissions and production waste, improvements in productivity and working conditions, reduced utility bill arrearage, local economic development "multiplier effects", local job creation, and other items EVT encounters in its program implementation. Related to this effort, the parties should consider offsets to estimated savings for projects which are likely to result in additional electrical sales due to increased manufacturing output .

Category 4: Process Issues to be Addressed on a Prospective Basis

Some of the issues raised relate more to program implementation processes rather than simply savings calculations. EVT and the DPS have agreed to establish an approach to discuss and resolve these issues.

1. CEO Program: T-8's

During the year 2000, incentives were paid above and beyond the incentive cap of $1000 for T-8's for four retrofit projects and one new construction project. These projects did not appear to have any extenuating circumstances, such as using the T-8's to leverage the installation of other measures or the need to provide additional assistance for schools or other municipal buildings. The DPS is concerned about the possibility of spending substantial amounts on incentives for a widely accepted technology such as T-8's.

EVT has a new form for prescriptive lighting that may help address this issue. In addition, EVT should review its criteria for waiving the "new" prescriptive cap (20,000 sf) so that its incentive structure is implemented with reasonable consistency.

2. REEP: File Documentation

The DPS found it difficult to identify the measures installed and to compare the hard copy files to the database records for the REEP program. One possible approach to make this process easier would be to construct a final inspection form with all the installed units on it. This inspection form could then be compared against the database.

3. General File Documentation

Many files contained numerous missing or undated documents. Internal procedures to assure that project documentation is complete and accurate and to identify where documentation resides (paper or electronic files) would be beneficial.

4. Lump Sum Costs

There are inconsistencies in the information entered into the "lump sum cost" field in the database. In general, these costs should reflect the incremental costs, but in some cases the entire project costs are entered. These inconsistencies create problems when all the project costs are aggregated into the annual report. This issue was particularly prevalent in the CEO program.

5. CEO Program: Oversight for Vendor Savings Estimated

EVT's process for verifying vendor estimates of savings is not readily revealed in the files. In some cases, it appears vendor savings estimates are accepted without EVT technical review.

6. ACE Adjustments

The adjustments to EVT's savings claims for the year 2000 necessitate corresponding adjustments to utilities' ACE savings where material. The DPS, EVT, and the Contract Administrator should discuss this.

7. Customer Credit Program

Although the Customer Credit Program is not included in the verification process, the DPS intends to review the measures installed through this program, particularly the measures which are subject to previous agreements, permit conditions and/or current baseline practices.

Technical Reference Manual (TRM) Review

In a March 9, 2001 memo from Carole Welch of the DPS to Dave Cawley and John Plunkett of EVT, Ms. Welch stated the DPS Reference Manual review for the February 22, 2001 additions and revisions would be integral to, and completed at the same time as, this verification process. She further stated it was likely that the Findings Summary Table for measures in question would be completed by April 12 meeting. With the benefit of hindsight, it's clear this proposed time line was optimistic. The DPS therefore proposes to complete its review of the February 22 modifications by June 15, 2001).[3]

During the process of "verifying" EVT's savings and TRB claims for 2000, the DPS identified a handful of significant issues related to the reference manual. Many of these are identified and discussed elsewhere in this document. However, a systematic review of all the revisions and additions could not be completed in the same time frame, given the short turn-around and labor intensiveness of the verification process. The February 22 changes are voluminous, the algorithms and embedded assumptions myriad and sometimes complex, and the manual itself is difficult to assimilate.

EVT proposed a process for the DPS TRM review initially in a draft procedure provided on January 31, 2001 and a subsequent February 22 memo from Dave Cawley. The procedure calls for the DPS to indicate, for each measure contained in the manual, the results of its review by putting it in one of three categories: (1) Accepted As Is; (2) Accepted with Edits; or (3) Referred to TAG.[4] The DPS and EVT have had considerable discussion about the meaning of the DPS "acceptance" and have tentatively agreed to the following:

> Changes identified in this verification process, and in the review of the February 22 modifications, will be applied retrospectively back to January 1, 2001, unless otherwise noted in this report. For TRM changes and revisions that are subject to future review, any changes or additions will be effective prospectively, defined as the effective date contained in the manual or 20 working days following the DPS receipt of the proposed modifications.

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[3] The DPS received additional Reference Manual revisions submitted by EVT on April 10, 2001, which the DPS intends to review within 20 working days, or by Tuesday, May 8, 2001.

[4] TAG is the Technical Advisory Group. See EVT procedure. _____..

The DPS will make every reasonable effort to conduct the February 2001 TRM update review in a way that minimizes the possibility of overlooking an item or assumption that might be the subject of dispute. However, in the event a significant error or clearly inappropriate assumption is not identified prior to June 15, 2001, the DPS reserves the right to challenge EVT's claimed savings and/or TRB flowing from that item at any time before the contract performance incentive award is determined. While this leaves EVT with more uncertainty than it would like, the DPS must preserve its right to challenge assumptions that are clearly incorrect or inappropriate.[5]

[5] The issue of the DPS "signing off" on savings assumptions has a long history in Vermont. It culminated in litigation in Docket 57015724, a 1994 CVPS rate case. It may be instructive to review the Board's discussion on the subject in that Order.

In addition to concern about CVPS's misstatement of unambiguous and relevant legal precedents, we conclude that CVPS's contention is impractical. If we adopted it, we would either have to allow rate recovery for <u>any</u> per-measure savings estimate regardless of its accuracy or probability, or we would have to have a Board investigation every time a savings estimate was proposed or revised.